GIST

New York City's Geographic Information System

By E. S. Savas
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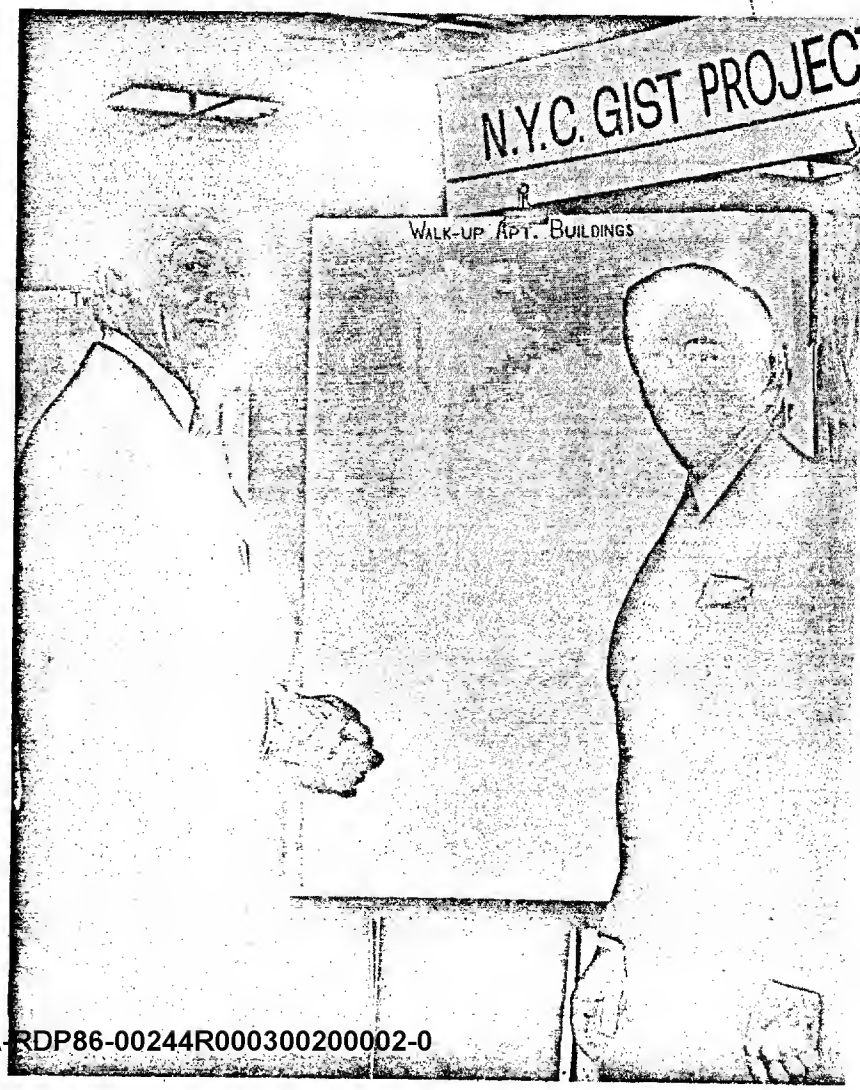


The author, right, with Mayor John V. Lindsay at Urban Technology Conference in New York City.

The Office of Administration of the Office of the Mayor of the City of New York initiated the development of GIST (Geographic Information System) as part of its responsibility to improve the effectiveness and efficiency of New York City government. GIST is a computer-based system which makes information on the basic physical, social, and economic aspects of New York City more accessible to all City agencies. The Office of Administration believes it to be the first general-purpose information system to be used routinely in the municipal operations of a major city.

To date, GIST has been installed and used at the computer installations of the Bureau of the Budget, Finance Administration, Department of Social Services, Health and Hospitals Corp. and Department of Traffic.

GIST was developed through the joint efforts of the Office of Administration and the Department of City Planning, with the cooperation of many other agencies.

The author, Dr. E. S. Savas, is New York's First Deputy City Administrator. The GIST project was initiated and carried out under Dr. Savas's direction.

If one looks at the land in a city, it is readily apparent that many municipal departments are concerned about the lots, the buildings, and the streets in one way or another. For example, one or more departments are interested in the following information: Where is a particular parcel of property located? Who owns it? What is it worth? What taxes does it pay? Is anything built on it? What is it used for? What licenses or permits have been issued for it? Is it a residential structure? Are there any outstanding housing code violations? Is it a rent controlled structure? Does it have an incinerator and has the incinerator been upgraded? Is there a water meter on the premises that must be read? When was the boiler last inspected? Have any fires been reported there? How many recipients of public assistance live there? How many police incidents occurred there in the last year? How many school-age children live there? At least 15 departments in New York City can be identified which are interested in the answers to one or more of these questions.

Now let's look at the items of interest to a supplementary group of departments, not those interested in blocks, lots, and buildings, but those interested in streets and intersections. What is the condition of a street? What is its width? What is the paving material and the base? When was it last repaired? What is the volume of traffic on it at different times of day? What sanitation route traverses that street? What kind of accidents occurred on that street segment? Are there traffic lights to be maintained there? Are sewer lines located below that street? Are there traffic signs located on that block which must be updated? Does a police car regularly traverse this street segment on patrol?

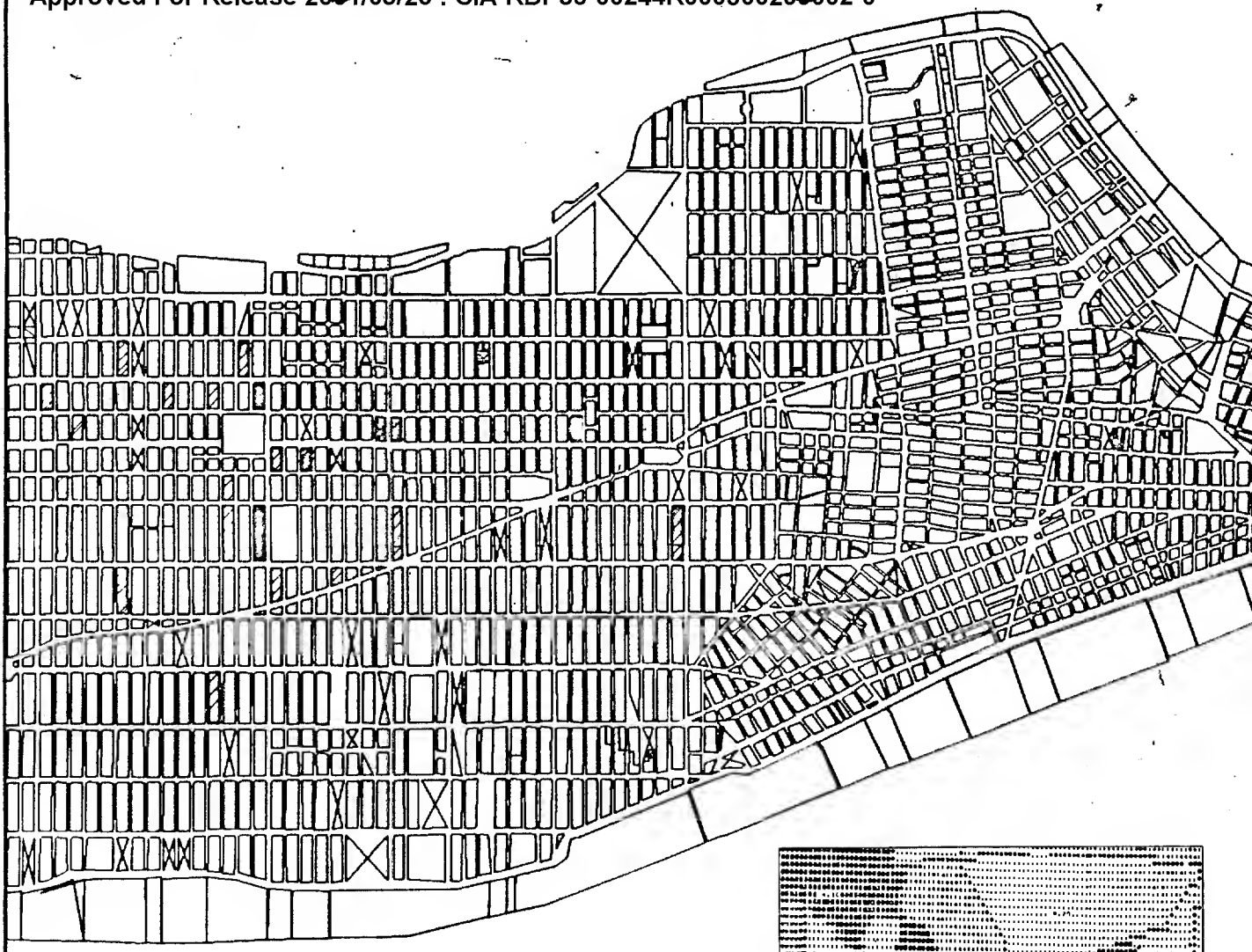
Need For Data Interchange

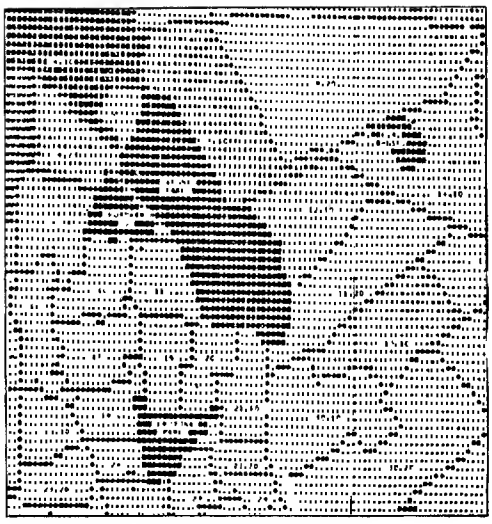
Given this immense proliferation of interest in properties and streets, it is not surprising to find a very large number of files maintained by numerous city agencies, each one with its particular parochial purpose. However, there is a crying need for data exchange between departments, because urban problems are interrelated and it is necessary to look at many facets of a problem, and many factors, in order to attack it. But there are many problems that inhibit effective interchange of such data among city departments:

- Files tend to be separate and uncoordinated. For example; one part of a housing department may be processing a rehabilitation application for a building only to discover that another unit in that department has already demolished that building.
- Files are often inaccessible. Let me recite an apocryphal story which does not apply to New York but which illustrates the type of problem:

A building was utterly destroyed by fire. During the subsequent investigation, the fire marshal tried to find out whether the boiler in that building had been adequately inspected, and he asked the boiler inspection people for information. The latter responded, "What was the number on the boiler? Tell us the number and we'll tell you when it was last inspected." The fire marshal said, "I don't know the number on the boiler, but I know the address where the boiler was located." The boiler inspector said, "Sorry, we only file the information by boiler number."

- Files are often inconsistent. For example, the City Register is sometimes embarrassed to discover, after he has certified a building as belonging to a specific individual, that the building in fact belongs to the city, which had taken possession some months earlier.
- Files are duplicated. For example, the Fire Department currently has a group of limited-duty firemen extracting data from building records in order to get information relevant to fire fighting. In general, each department tries to become totally self-sufficient, which leads to very expensive and duplicated data collection.
- Files are often incompatible. For example, some files refer to a building by its tax block and lot number whereas others may refer to the same building by its street address. As another example, our Police Department uses a four-digit code to identify each street, whereas our Housing Department uses a totally different five-digit code for the same purpose. For the same reason, it is





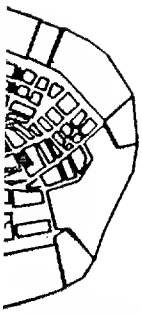
difficult to relate census data to data collected by city agencies, and the 1970 census presents the city planner with a veritable embarrassment of riches.

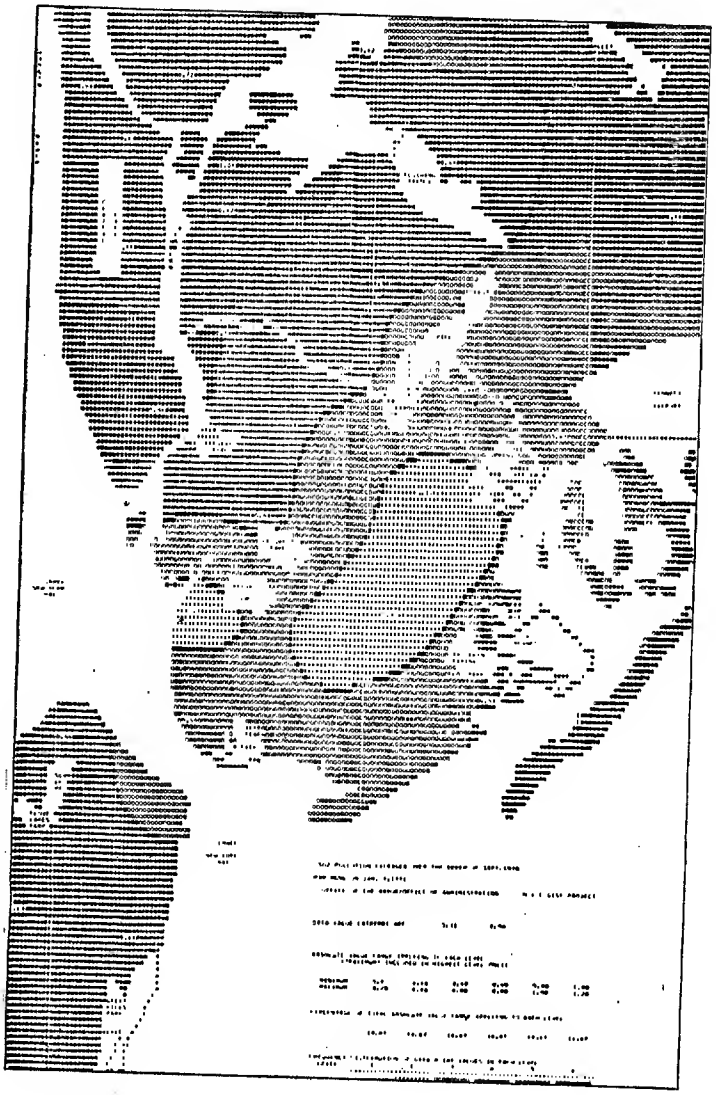
Elements Of GIST

As part of its responsibility to improve the effectiveness and efficiency of New York City government, the Office of the Mayor conceived of GIST (Geographic Information System) as a tool to attack the problems of data interchange. Its objective is to make accessible to all city agencies the geographically oriented data which is routinely gathered and maintained in machine-readable form by any agency. Three key features in the overall design philosophy of GIST are the following: 1) It relies on agency-maintained satellite files rather than on a massive central repository of data; 2) it employs a centralized, user-oriented method of data interchange; and 3) it provides centralized tools for data analysis and display.

The principal elements of GISTS are: a set of main files; address-processor package; map-generation package; and data-manipulation package.

The three principal files of GIST are the following: (1) Street file, which gives the official name and all common names and spellings of a street, and any major numerical code designations





Left: Map produced by a computer-driven cathode ray beam, showing individual blocks of lower Manhattan. Below: Map showing concentration of Sulfur Dioxide in NYC. Below, left: A portion of the Bronx, segmented into Health Areas. These maps were prepared on a standard computer printer.

used by various departments for that street. (2) Block-face file, which has for each block-face in the city the address range of buildings on that block-face, the names of intersecting streets, the tax block number, the census tract and block number, the health area number, zip code, community planning district, and the precise geographic coordinates of the block. (3) Building and lot file, which will contain, for each of the 830,000 land parcels in the city, the name of the owner, description of the property, its size, use, and value, permits and licenses pertaining to that building, and any alternative addresses by which the building or property is known.

The address-processor system permits matching of addresses despite significant differences in spelling, format, and conventions used in different departments to record street addresses.

The map-generation package produces maps showing a variety of features of interest. For example, it produces incidence maps showing the location of such events as emergency ambulance calls, contour maps showing sulfur dioxide concentration in the atmosphere, and district maps showing the number of food-stamp recipients in each neighborhood.

Various data-manipulation packages enable the user of GIST to aggregate, tabulate, and extract data of interest to him.

Use Of GIST

Typical recent uses of GIST follow:

A file of 390,000 welfare case records representing over 1 million welfare recipients was processed to match each address to census tract, census block and health area. The resulting data was used by the Board of Education to determine the number of school-aged children eligible for free lunch funds in each school district. The information was also used in planning for the food stamp program.

A file of 150,000 multiple-dwelling records was processed to match each address to the assessor's tax block number. This work is assisting the Housing and Development Administration in determining the taxes on each apartment house covered by the new rent control law.

A series of computer-generated maps was prepared showing the distribution of buildings by type (elevator apartments, tenements, office buildings, etc.) throughout the city. These maps were prepared for a study of property taxing policy.

Plans are being developed with the Department of Health to use GIST programs to code all vital

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statistics records with health area and census tract and block. This will produce more accurate health area coding at lower cost and allow more detailed analysis of birth and death data by other agencies.

In summary, GIST is a powerful tool that is already aiding the City of New York and improving our ability to both plan and execute programs to benefit our citizens.

GIST Operating Capabilities

The following highlight the characteristics of GIST's four operating elements:

1. GIST Geographic Base File (GBF)
2. GIST Address Preprocessor Program
3. GIST Address Matcher Program
4. Map Generator Program (SYMAP)

1. *GIST Geographic Base File (GBF)*

A Master Reference File; contains one record for each blockface (blockside) in N.Y.C. (240,000 blockfaces, 50,000 blocks); 330 characters of data for each blockface including:

- Street name
- Range of permissible house numbers (highest and lowest nos. on each blockside)
- Intersecting street names
- Block centroid coordinates (x,y)
- 1960 Census tract and block numbers
- Tax Assessors' block no. and suffix
- Health area
- Community Planning District
- Zip Code

Used for summarizing and reorganizing agency data; for mapping, routing and districting; for address matching.

2. *GIST Address Preprocessor Program*

Restructures address components in card or tape data file:

House number	City
Street name	County
Borough code	State
Community name	Zip code

Creates tape record output with 100-character prefix containing restructured address components.

- Used for matching or manipulating address records
- Required before using GIST Address Matcher Program

Processes 100,000 records per hour (using IBM System 360 / 40).

3. *GIST Address Matching Program*

Matches restructured data file against blockside records of the Address Disctionary (subset of Geographic Base File) on address.

Will produce output tape file that contains the input data file plus any combination of the desired fields from the "matched" blockside record, e.g.:

- Health area
- 1960 Census tract and block no.
- Tax Assessors' block no.
- Block centroid coordinates (x,y)

and others as available from the GIST Geographic Base File

Used to summarize, analyze and group data on the basis of address; assists mapping, districting and routing activities.

Processes 90,000 records per hour (using IBM System 360 / 40).

4. *Map Generator Program (SYMAP)*

Creates automatic maps of each borough or of all city using available hardware (IBM S / 360 line printer)

- District Maps:
  - —for Health Areas by borough
  - —for CPDs by borough and city-wide
- Contour Maps by borough and city-wide:
  - —for air pollution stations
  - —for Census tract centroids
- Incident Maps by borough and city-wide:
  - —pinpoints locations of specific addresses or groups of incidents.
- Network Maps by borough or community:
  - —uses lines of varying density to show movement from point to point.

Produces a one-panel map in six minutes, two-panel map in 15 minutes (using IBM System 360 / 40). □

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